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ABSTRACT

Cognitive style research is hindered by a variety of poorly described measures and style classifications and the use of small samples. This study described and compared three group measures of impulsivity/reflectivity, internal/external locus of control; and field dependence/independence to determine the distribution characteristics, psychometric properties, and underlying factor structure of all three instruments, using responses from 274 male and female seventh grade students. Results indicated a need for psychometric refinement of measures and suggest revision of current notions of the factor structure of the domain. (Author)

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Three Measures of Cognitive Style: Characteristics, Factor Structure, and Implications for Researchers

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Objectives

Despite continuing interest in the topic, research on cognitive style has very little coherence because studies use a variety of measurement strategies and style classifications and, for the most part, focus on relatively small groups. There has been little or no effort to describe the measures used to determine cognitive style, or to describe and compare the results of several instruments administered to a single large sample.

Authors postulate many dimensions of the cognitive style domain, three of which are: impulsivity/reflectivity; internal/external locus of control, and; field dependence/independence.

The present study described and compared measures related to each of these three proposed dimensions to determine and compare:

1) the characteristics of the distributions yielded by each measure
2) the psychometric characteristics of the items comprising each measure
3) the underlying factor structure of each measure.

Also, there was consideration of whether the three tests yielded separate factors as implied by the different terms used to describe the domain of cognitive style.

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Prospectives

From a theoretical standpoint, the study was designed to clarify as

well as lend prospective to a topic that appears to offer no well-defined theory and which appears to have grown in a number of directions simultaneously without much pause for reflection. Since one requirement for any good theory or model directing research endeavors is parsimony, the present study was an attempt to see just how parsimonious the three purported dimensions are for describing all or part of the cognitive style domain.

From a procedural standpoint, the study was designed to provide information for researchers about the characteristics of three measures of three different purported dimensions of cognitive style. This information should assist in formulating future research priorities, selecting measures, and interpreting the results of these measures.

Method

The Sample

The 274 subject sample consisted of the entire seventh grade of a suburban Connecticut junior high school (143 males and 131 females). This sample was predominantly of Anglo descent; socio-economic position was predominantly upper and upper middle class, with average IQ levels around 110.

The Instruments

Following an extensive search for group-administered instruments suited to this age group and the time constraints imposed upon the study, three group measures of cognitive style were selected and used. They are: The Group Embedded Figures Test (Oltman, Raskin, and Witkin, 1971); The Nowicki-Strickland Locus of Control Scale for Children (Nowicki and Strickland, 1971); and the Sutton-Smith and Rosenberg Impulsivity Scale (Sutton-Smith and Rosenberg, undated). The latter measure was revised and expanded for use in the study. Samples of the Nowicki-Strickland and Sutton-Smith and Rosenberg

instrument appear in the Appendix.

Data-Gathering Procedure

About 3 weeks before the actual administration of the measures, the subjects were visited in class groups and given a brief orientation to the study, including assurance of anonymity and an introduction to the format of the three measures. On the testing day, regular groups from core classes reported to a cafeteria area during their class period. The measures were administered in a completely counterbalanced order, with the 6 different "modes" assigned to groups via a random number table (Table 1); likewise, the researcher and an assistant were assigned randomly to conditions as testors. Total testing time for the three measures averaged 32 minutes per group. All groups completed all instruments within the regular assigned class period.

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Insert Table 1 about here
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Scoring and Analysis

Following the completion of testing, the following data were derived and recorded on punched cards for each student: sex, birthdate, individual item responses on the three measures, and total scores on the three measures. These data were analyzed by application of SPSS and other computer packages to derive: descriptive data for each test; item analysis data for each test; reliability estimates for each test; and the factor structure of each test. In addition, the item responses on all three tests were combined in an analysis describing the factor structure of the entire set of items.

Results and Discussion

The Nowicki-Strickland Locus of Control Scale for Children

This instrument is a descendant of the scales developed by Rotter (1966), Bialer and Cromwell (1961) and others to measure "the locus of control of reinforcement dimension in children" (Nowicki and Strickland, 1971, p. 2). This dimension has been described by Rotter, who remarks that:

> When a reinforcement is perceived by the subject as following some action of his own but not being contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control. (p. 1)

Several researchers, including Colemen et al. (1966) have indicated that locus of control-related beliefs appear to have an influence on school achievement and this construct has thus played a very strong role in the literature on cognitive style.

The Nowicki-Strickland Scale was chosen for this investigation because one form of the scale was applicable directly for the seventh grade sample being studied. Moreover, the authors of the scale provide a good deal of documentation regarding its development and its promise as a research instrument (Nowicki and Strickland, 1971). The scale also matched the more pragmatic requirements of ease of administration to large groups within a limited period of time. The data derived in the present study added to the information already known about the instrument. The reported corrected internal-consistency estimate for the 21-item form used in this study was .68 ($n = 54$) and the test-retest reliability estimate involving a 6-week interval

derived from the same seventh grade sample was .66 (Nowicki and Strickland, 1971). Item-total correlations derived by the authors of the scale were also available and could thus be compared with the indices obtained in the present study.

The instrument consists of 21 statements in question form, to be answered by circling "yes" or "no". The present study used the intact original instrument with questions in the same order. The only noticable changes were the omission of the title--N S Personal Reaction Survey Grades 7 through 12--and the insertion of directions and items concerning demographic data at the beginning of the survey (see Appendix A). All items were keyed positively except items 4, 13, and 20; with high scores indicating externality. No norms were available for the instrument.

The descriptive data derived from the administration of the Nowicki-Strickland Locus of Control Scale for Children appear in Figure 1. The reliability of the instrument was determined in the present study by the use of the Kuder Richardson 20 estimate of internal consistency. The obtained value for KR_{20} was .58.

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Insert Figure 1 about here
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Item characteristic data appear in Table 2. The item total correlations offered by Nowicki and Strickland are shown in columns 2 and 3, while the indices derived from the present study are shown in column 1.

Examination of the score distribution for the instrument (Table 2) indicates a symmetrical distribution of scores that is, at the same time, markedly leptokurtic. However, it is also apparent that the entire range of scores (0-21) on this instrument is being "used" since the scores of the present group ranged from 1-19. This is a useful finding, especially in

view of the comparative homogeneity of the group being described with respect to scholastic aptitude, reported school achievement level, and socio-economic status. Range restriction associated with these factors does not seem to be a potential difficulty in this instrument.

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Insert Table 2 about here
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The shape of the score distribution and the summary statistics for the present group also indicate possible difficulties in using an instrument such as the Nowicki-Strickland Locus of Control Scale for Children for categorization of subjects into dichotomous groups of "internals" vs. "externals". The bulk of the group cannot be neatly classified since their scores fall rather resoundingly in the center of the distribution. Nor would a median split be of much use here since the probability of faulty classification near the cutoff is potentially quite large. Indeed, there is only a 4 point spread of scores for the middle 50% of the group. Using only the high and low quarters of the group for the extremes is probably the safest practical solution in this case, although this indicates that the initial sample size necessary to achieve these classifications could be at least twice that of the projected final group--a rather expensive procedure in terms of time and resources. Frankly, it would be desirable to construct a scale that yields a bimodal distribution which would facilitate categorization into dichotomous groups and then to apply distribution-free statistics to analysis of data derived as the result of such classification.

The categorization problem is intensified when the reliability of the instrument is considered. Although .58 could be considered a lower-bound estimate, it is an inescapable conclusion that the consistency of the Nowicki-Strickland scale is modest. This further accentuates the potential folly of

using scores near the center of the distribution in forming group categorizations.

Examination of the item analysis information leads one to question the unidimensionality of the scale since item-total correlations obtained from the present group range all the way from -.06 to .48. Since these estimates were derived without deletion of the respective item from the total score, they can be regarded as slightly inflated. The three items with the smallest values were the three negatively-keyed items. Althoug it is usually advisable to include negative items in a scale such as this to preclude acquiescent tendencies, this procedure actually seems to have detracted from the scale in this instance even though these three items did form a distinct group when compared to the 18 positively-keyed items. Moreover, the examination of the response style difficulty with measures of cognitive style do not tend to show conclusively that acquiesence is of major concern to developers of assessment strategies (Sutton-Smith and Rosenberg, undated).

To further examine this instrument, item responses were subjected to factor analyses and the results of a principal axes factor analysis with varimax orthogonal rotation for the 21 Nowicki-Strickland items revealed one very strong first factor accounting for approximately 70% of the common factor variance. A second factor was extracted which accounted for the remaining 30% of the common factor variance.

Of the 21 test items, eleven had loadings above .30 on one of the two factors. Table 3 contains the arrays for each factor. Unfortunately, the remaining 10 items did not have meaningful loadings on either factor.

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Insert Table 3 about here
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Thus, the Nowicki-Strickland does not seem to represent a completely

homogeneous measure of the internal vs. external locus of control dimension. Moreover, close to half the items on the test failed to load meaningfully on either of the extracted factors.

In view of this and the modest internal consistency of the items on the Nowicki-Strickland Locus of Control Scale for Children and the type of distribution it yielded in this study, the usefulness of this instrument is rather limited. Although most of the items function in the desired direction, a good deal of refinement must be done with this instrument before it can be used with any confidence.

The Sutton-Smith, Rosenberg Impulsivity Scale--D version

Although the impulsivity/reflectivity dimension is generally thought of as a component or correlate of cognitive style, it was difficult to locate a suitable measure of this construct for this age level. The Sutton-Smith, Rosenberg scale (Sutton-Smith and Rosenberg, undated) was deemed the most appropriate instrument although modifications were made in the scale before it was used.

The original scale was developed over a period from 1959 to 1965 (Sutton-Smith and Rosenberg, 1959 a, b, 1961; Hirschfield, 1965) using the following general definition of "impulsivity": "...the tendency of the child to be restless, indulge in horseplay, lose control of his feelings, break the rules, enter activities with overwhelming vigor, and generally lose control in acceptable and unacceptable ways." (Sutton-Smith and Rosenberg, undated, p. 1) The latest version, resulting from Hirschfield's work was the starting point for the revision used here. The instrument consisted of 25 items (see Appendix B), several of which were judged inappropriate because of awkward wording, emphasis on activities with low social desirability (i.e. throwing

stones) or possible invasion of privacy (i.e. "My home life is not always happy). The modified version of the scale (D-version) appears in Appendix C. It contains 17 "old" items, 11 of which were unchanged from the original and 6 of which were edited slightly. These items appear as the first 17 items in the D-version. In addition, 13 new items were written and these appear as items 18 through 30 in the D-version. The new items, like the original items, were all keyed "yes" for impulsivity. Other modifications included omission of the title--What I like to do--and use of the same demographic items and instructions used for the Nowicki-Strickland Locus of Control Scale for Children described earlier. Since modifications were made in the scale, it is inappropriate to cite reliability and item characteristic data derived for the original scale. Moreover, since the scale underwent several changes in its development, the matching of extant item characteristic data to the particular version of the scale from which they were derived would be difficult.

The descriptive data derived from administration of the Sutton-Smith, Rosenberg Impulsivity Scale--D version, appear in Figure 2. The reliability of the D-version was determined by use of the Kuder-Richardson 20 estimate of internal consistency. The obtained value of KR_{20} was .74.

Item characteristic data for the instrument appear in Table 4.

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Insert Table 4 about here

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This instrument yielded scores which, like the Nowicki-Strickland scale, arranged themselves in a unimodal symmetrical distribution. Out of a possible score range of 0-30, the present group obtained scores ranging from 3 to 26. The importance of this large obtained score range in view of the homogeneity of the group has been indicated above, as has the possible difficulty of using a scale yielding such a distribution to form dichotomized

groups. Fortunately, several mitigating circumstances appear in connection with the Sutton-Smith, Rosenberg Scale D-version that render it a bit more usable than the Nowicki-Strickland. First, the distribution is wide enough to permit a rather large score range for the middle half of the group (7 points). Also, the reliability of the instrument (.78) is more encouraging than that of the Nowicki-Strickland scale, indicating more homogeneity among the items.

Unfortunately, since no data on item-total correlations could be located for the original scale, no comparisons could be made. However, average item-total correlations for the "old" items was .36 and average item-total correlations for the "new" items was .32. When item 18, which clearly did not perform well in the scale, is deleted, the values would probably be more indicative of the values to be expected upon actual application of the instrument.

The principal axes factor analysis with varimax orthogonal rotation of the Sutton-Smith and Rosenberg Impulsivity Scale--D version items revealed that 15 of the 30 items had loadings of .30 or greater on one of two factors accounting for 75% and 25% of the common factor variance respectively. Two items (#6 and #17) had loadings of .30 or more on both factors and could not be readily placed in one or the other on the basis of their loadings alone.

Table 5 shows the items loading on each factor.

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As with the Nowicki-Strickland measure, the Sutton-Smith and Rosenberg--D version does not appear to be a homogeneous instrument. Although only two factors appear, almost half the items do not relate meaningfully to either of them.

The Group Embedded Figures Test (GEFT)

Designed as an adaptation of an individually-administered test of the perceptually-based field dependence/field independence dimension, this instrument was developed by Oltman, Raskin, and Witkin (1971). The test contains three sections: an unscored practice section with 7 items, and two sections with 9 items each which are both timed and scored. Items in each section are arranged in order of difficulty. Although intended to be "a flexible instrument for use with groups widely diversified in age and background" (Oltman, Raskin, and Witkin, 1971, p. 28), the only normative and reliability data available for the instrument in the manual are for liberal arts college students. Moreover, although the authors recommend adjusting the 5-minute time limit allotted to complete each 9-item section for groups other than adults, no exact guidelines are given since this instrument is admittedly in the research stage of development. The correlation of the two scored sections using the Spearman Brown Prophecy Formula is .82 and this is the only reliability datum offered in the manual (Oltman, Raskin, and Witkin, p. 28). The present study was an opportunity to add needed information to that already available for this instrument.

For this study, the Group Embedded Figures Test was used in its exact published form and directions were the same as those offered in the manual. However, subjects were asked to fill in only their birthdate in the section asking for identifying information. The only other modification was the allottment of 6 minutes per section instead of 5 minutes. This change was in accord with the authors' suggestion and would be recommended for future use of this instrument with groups similar to the one used in the present study.

Descriptive data derived from administration of the GEFT appear in

Figures 3a, 3b and 3c.

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Insert Figures 3a, 3b and 3c about here
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The relibaility of the GEFT was estimated by several methods. Internal consistency estimates based on KR_{20} were derived for each 9-item section. In addition, an internal consistency estimate was calculated for the 18-item total. However, the reader is cautioned that these estimates may be inflated by the speed factor involved in the test. The correlation of the two separately timed and scored sections was also computed, along with the adjustment using the Spearman Brown Prophecy Formula. These data appear in Table 6.

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Finally, item total correlations were computed for each section separately and for the combination of the two sections. However, the reader is again reminded that the speed factor in the test probably led to inflated reliability estimates, especially for items appearing near the end of each section. These data appear in Table 7.

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Insert Table 7 about here
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The GEFT score distributions shown in Figures 3a, 3b and 3c clearly show the presence of both a speed effect and a practice effect in the instrument. The speed factor is most clearly evident in section 1 results which show a definite positive skew. The practice effect in section 2 results is most apparent from the general elevation of the distribution as well as from its shape. Comparison of the means and medians of the two distributions shown in Figures 3a and 3b also indicate a difference in the general characteristics of the distributions.

These practice and speed effects mitigate against the comparability of sections 1 and 2 of the GEFT despite the test authors' claim that these sections are actually alternate forms of a 9-item task (Oltman, Raskin, and Witkin, 1971, p. 27). This observation is further reinforced by the uncorrected correlation of .76 between the two sections obtained in the present study and reported in Table 6. This is less than desirable even though each section consists of only 9 items. The corrected value of .81 is not much more satisfactory even though it compares with the value reported by the authors in the test manual.

Examination of the score distribution for the entire test presented in Figure 3c reveals a slight negative skew and a wide range of scores. A comparison of this distribution with those of each section considered separately indicates that use of the total score would result in a very different picture than consideration of either of the sections separately. While not symmetrical, the total score distribution does seem more usable than the half-test distributions, indicating that part scores for the GEFT should be viewed with extreme caution and that, for research purposes, the total score would be more useful. Again selection of the upper quarters would be suggested for formation of extreme groups since there appears to be a satisfactory separation between these portions of the distribution. However, because of the speed and practice factors pointed out earlier, it is probable that more is being measured by this instrument than field dependence/field independence, especially since the test authors offer scanty evidence of validity.

The item-total correlations cited in Table 7 rather clearly show the inflation that results from use of these indices with speeded or shortened tests since, in every case except one, the values reported for the total test are smaller than those reported for the sections taken separately. The

reported item-total correlations are respectable, with only one item below .40. Although a general inflation has undoubtedly occurred, the homogeneity of the items cannot be seriously questioned although even higher item-total correlations might have been expected in view of the type of items comprising the GEFT. The item content is figural, and require processes that are more perceptual than judgmental. Moreover, there is a correct solution to each item in contrast to instruments that are of a self-report nature.

This conclusion is given further support by the results of factor analyses of GEFT responses. Three analyses of the GEFT were performed: one on each of the separate sections of the instrument, and a third on the two sections combined.

Each analysis yielded only one strong factor using principal axes factor analysis with varimax orthogonal rotation (see Table 8). This factor accounted for 86% of the common factor variance for Part I of the GEFT. The remaining 14% of the variance in Part I of the test was accounted for by a small second factor which showed meaningful loadings for only two items (#7 and #8). A first factor ccounted for 100 percent of the common factor variance in both Part II and the total test with all items loading meaningfully on the single factor.

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Thus, results of the factor analysis showed quite clearly that the GEFT is a unidimensional measure. In general, the GEFT appears to be a fairly usuable instrument although the speed and practice factors should be examined further, and the total score rather than part scores should definitely be used.

Other Results and Discussion

In order to compare the results of the three measures, their score distributions were plotted together in Table 11. Examination of this table further illustrates the leptokurtic tendency of the NS distribution and the relative symmetry of the three distributions of total scores.

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Insert Figure 4 about here
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Since all three measures were administered to the same group, there was an opportunity to compare the scores on the instrument by derivation of a table of intercorrelations. These data are presented in Table 12. All intercorrelations are statistically significant and indicate a modest relationship among the three measures. However, the magnitude of the relationships does not justify the conclusion that there is a significant redundancy in the measures in terms of shared variance, with the possible exception of the NS and SR-D version overlap.

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Insert Table 9 about here
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Moreover, if these three measures are actually tapping different dimensions of a cognitive style domain, then the existence of some relationship among them would be expected due to the presence of a probable common source of variance.

Thus, while the relationships among the measures are statistically significant, there does appear to be sufficient independence in the results of the instruments to conclude that they are not all tapping the same variance sources.

The question of the independence of the measures was examined further by use of factor analysis. All of the items on the three measures (69 in all)

were subjected to an overall analysis based on the notion that if the measures were indeed independent, a series of factors would emerge showing meaningful loadings on only those items from a particular measure. Thus, one or more field dependence factors, one or more locus of control factors, and one or more impulsivity factors would result from the combined analysis.

This was an admittedly optimistic expectation considering the previously discussed quality of the three measures and the results were predictably dismal. Principal axes factor analysis with varimax orthogonal rotation yielded a 24 factor solution with the strongest factor accounting for only 21 percent of the common factor variance, the second factor accounting for only 12 percent of the common factor variance, and the remaining factors each accounting for between 1% and 9% of the common factor variance (see Table 10). Meaningful factor loadings were, with one remarkable exception, sprinkled all across the 24 factors with no clear pattern emerging. The exception was that <u>all</u> of the GEFT items loaded meaningfully on the first factor and <u>only</u> the first factor. Among the items from the other measures, <u>none</u> had meaningful loadings on this factor.

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Insert Table 10 about here
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These reults are not entirely surprising in light of the findings for the individual measures. However, they do suggest that, while the perceptual dimension of "cognitive style" is reasonably stable and homogeneous, it is certainly not the <u>only</u> dimension that emerges, nor is it the only one that deserves attention from the research community. Furthermore, the results of the factor analysis with the full complement of items from the three measures is an excellent illustration of the GIGO principle of data manipulation and the necessity of having reasonably stable measures before such analysis can

be successfully undertaken.

Summary of Conclusions and Implications

The results of the study generally indicate that the three instruments examined are not shining examples of psychometric excellence. The Group Embedded Figures Test appears to be most homogeneous in content though probably flawed by speed and practice effects. The Sutton-Smith and Rosenberg Impulsivity Scale for Children is fairly usable and has minimally satisfactory homogeneity in its revised form. The Nowicki-Strickland Locus of Control Scale for Children is the least promising of the instruments examined since it shows a very small differentiation of cases in the middle of the scale and has only modest reliability.

All three instruments yield distributions of total scores that encompass almost the entire range of possible scores, an indication that the homogeneity of the subjects used in the study did not have an attenuating effect on score ranges. None of the instruments yielded a bimodal distribution which would have been most effective for categorizing subjects into groups. This observation, together with the generally modest reliability of the instruments, suggested that use of the upper and lower quarters for forming dichotomized groups would be advisable although this procedure tends to be both wasteful and not indicative of overall population values.

Of course, this does not preclude the possibility that the variables under consideration are continuously distributed. Distributions such as those obtained in the present study would be appropriate in cases where extreme groups are not of interest, the assumption of normality in the characteristic is made, and/or analysis procedures assuming an underlying normal distribution are used.

All three tests appear appropriate to and well-received by the subjects involved in the study and were suited to groups as large as those employed here, as well as being appropriate for use within fairly strict time constraints.

With respect to the factor analysis of the instruments, the results were puzzling. Only the Group Embedded Figures Test yielded a clear first factor. The other instruments yielded two or more strong factors. The results of the factor analysis with the full complement of items from all three instruments yielded no less than 24 distinct factors; and an examination of the items loading on each factor does not reveal a clear set of factor descriptions aside from a perceptual dimension as denoted by GEFT items. Thus, the presence of three distinct dimensions of the cognitive styel domain as suggested by the instrument titles can be regarded as tentative despite the seemingly low intercorrelations among the test results. However, the limited reliability and accompanying measurement error may actually have "masked" the factors and resulted in an artificial fuzziness in the dimensions.

The user of these instruments must regard them as research instruments which yield results of only modest reliability, require a good deal of technical refinement, and should be interpreted with extreme caution. The instruments are probably not suitable for extremely small samples, nor for application of statistical procedures that are influenced by score distribution characteristics, though homogeneous samples do not present significant difficulties in score interpretation. Moreover, the independence of the dimensions described by the measures is still questionable.

Importance of the Study

The topic of cognitive style has exciting possibilities for the provision

of instructional climates optimally rewarding to both student and teacher. However, many of those approaching this interesting research topic are very quickly frustrated when they find inconsistencies in their results and/or severely limited replicability of findings. Critics of cognitive style research tend to cite these problems as evidence that it is a "non topic". Instead, this study suggests some possible reasons for this frustration and criticism. The results of the study highlight the need for researchers of cognitive style to refine the measures used to describe the domain; engage in some theory-building and testing; and apply information about the characteristics of available instruments in selecting measures, formulating research questions, and interpreting results of their research.

APPENDIX A

DIRECTIONS

Please indicate:

your sex (circle one) MALE FEMALE

your birthday: (Month, day, year i.e. July 4, 1960)

_____

your average report card grade: (circle one)

A B C D F

Read each of the statements below. Decide whether or not you agree with the statement.

Mark "yes" if you think the statement is right most of the time or all of the time.

Mark "no" if you don't think the statement is right very often or at all.

There are no right or wrong answers. Mark each statement to show what you think. Your answers will be used in a research study. However, no one, not even the researchers, will need to know who you are. Thank you for your help.

Circle one

YES NO 1. Are some kids just born lucky?

YES NO 2. Are you often blamed for things that just aren't your fault?

YES NO 3. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?

YES NO 4. Do you feel that most of the time parents listen to what their children have to say?

YES NO 5. When you get punished does it usually seem it's for no good reason at all?

YES NO 6. Most of the time do you find it hard to change a friend's mind (opinion)?

YES NO 7. Do you feel that it's nearly impossible to change your parent's mind about anything?

YES NO 8. Do you feel that when you do something wrong there's very little you can do to make it right?

Mark "yes" if you think the statement is right most of the time or all of the time.

Mark "no" if you don't think the statement is right very often or at all.

Circle one

YES NO 9. Do you believe that most kids are just born good at sports?

YES NO 10. Do you feel that one of the best ways to handle most problems is just not to think about them?

YES NO 11. Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her?

YES NO 12. Have you felt that when people were mean to you it was usually for no reason at all?

YES NO 13. Most of the time, do you feel that you can change what might happen tomorrow by what you do today?

YES NO 14. Do you believe that when bad things are going to happen they are going to happen no matter what you try to do to stop them?

YES NO 15. Most of the time do you find it useless to try to get your own way at home?

YES NO 16. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?

YES NO 17. Do you usually feel that you have little to say about what you get to eat at home?

YES NO 18. Do you feel that when someone doesn't like you there's little you can do about it?

YES NO 19. Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you are?

YES NO 20. Are you the kind of person who believes that planning ahead makes things turn out better?

YES NO 21. Most of the time, do you feel that you have little to say about what your family decides to do?

APPENDIX B

DIRECTIONS

Please indicate:

your sex (circle one) MALE FEMALE

your birthday: (Month, day, year i.e. July 4, 1960)

_____

your average report card grade: (circle one)

A B C D F

Read each of the sentences below. Decide whether or not you agree with the statement.

Mark "yes" if you think the statement is right most of the time or all of the time.

Mark "no" if you don't think the statement is right very often or at all.

There are no right or wrong answers. Mark each statement to show what you think. Your answers will be used in a research study. However, no one, not even the researchers will need to know who you are. Thank you for your help.

Circle one

YES NO 1. I like to keep moving around.

YES NO 2. I make friends easily.

YES NO 3. I must admit I'm a pretty good talker.

YES NO 4. Whenever there's a fire engine going someplace, I'd like to follow it.

YES NO 5. When things get quiet, I like to stir them up a little.

YES NO 6. I am restless.

YES NO 7. I like being "it" when games of that sort are played.

YES NO 8. It's fun to push people off the edge into a swimming pool.

YES NO 9. It's hard to stick to the rule if you're losing the game.

YES NO 10. I like to dare people to do things.

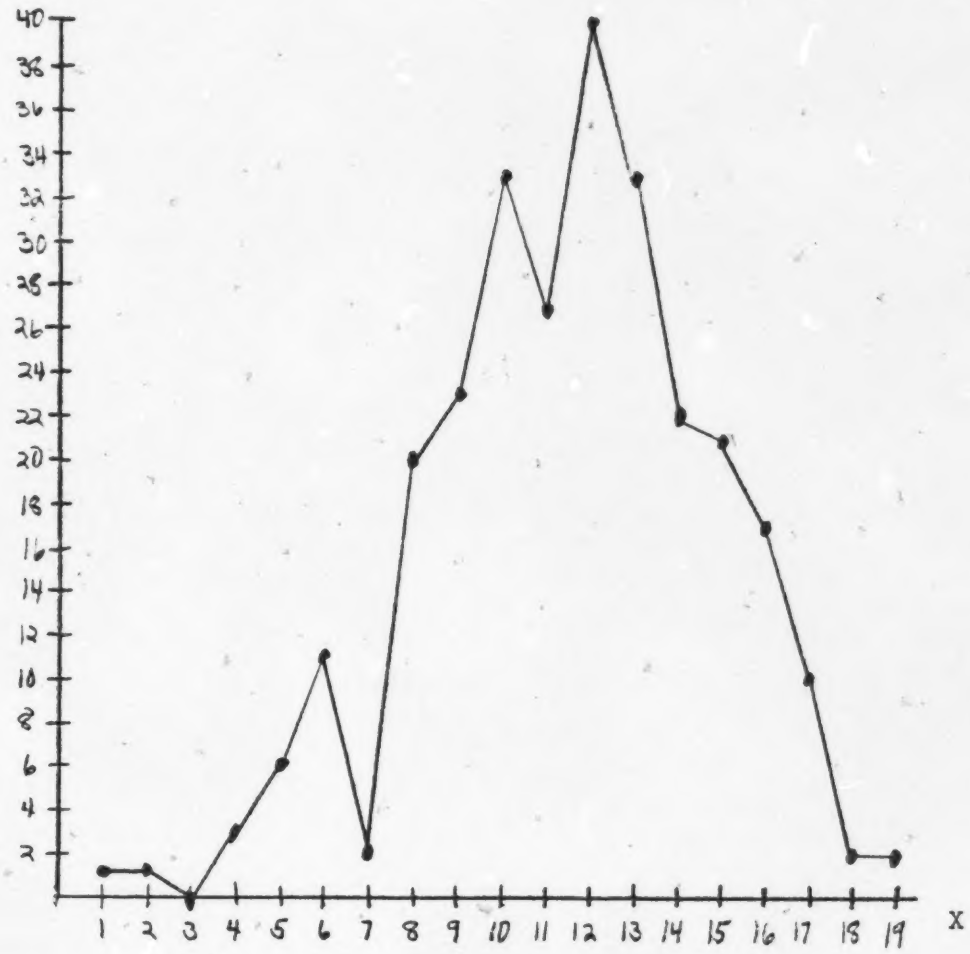
Mark "yes" if you think the statement is right most of the time or all of the time.

Mark "no" if you don't think the statement is right very often or at all.

Circle one

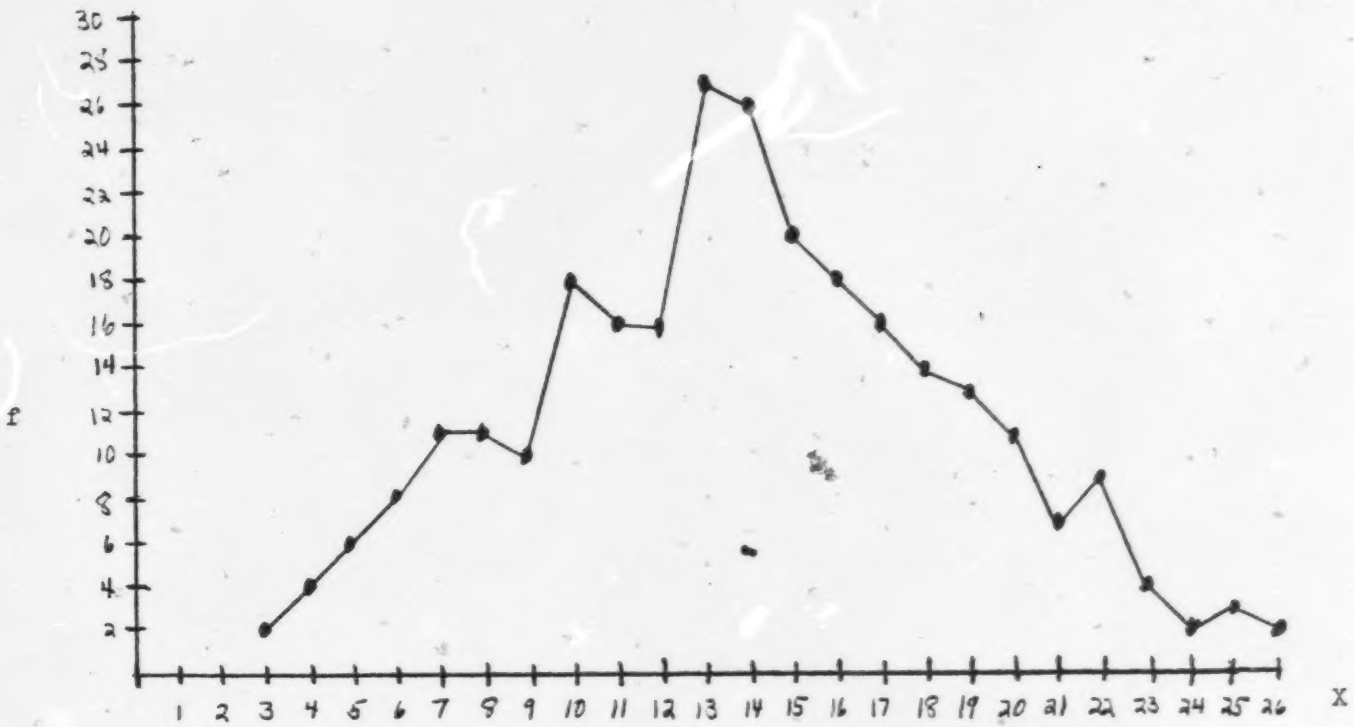
YES	NO	11.	I like to go around with lots of other people, not just one or two.
YES	NO	12.	I'm not known as a hard and steady worker.
YES	NO	13.	I like to just "blow off" steam.
YES	NO	14.	I don't think you should always have to do what you're told.
YES	NO	15.	I'll try almost anything once.
YES	NO	16.	I usually say the first thing that comes into my head.
YES	NO	17.	I often act on the spur of the moment without stopping to think.
YES	NO	18.	I can't concentrate on my work when people are talking in the room.
YES	NO	19.	It's hard for me to save money even when I want to.
YES	NO	20.	When people are playing an exciting game, I want to get in it rather than just watch.
YES	NO	21.	I can't sit still when I hear really good music.
YES	NO	22.	It's fun to take chances.
YES	NO	23.	Sometimes I say or do things just to see how people will react.
YES	NO	24.	I buy things I don't need because I like them.
YES	NO	25.	I think museums are boring.
YES	NO	26.	I like "hard rock" music better than "soft rock" music.
YES	NO	27.	I seem to get into trouble a lot without even planning to.
YES	NO	28.	My friends think I'm a "character".
YES	NO	29.	I don't like to follow schedules or routines.
YES	NO	30.	I like to "tinker" with things.

Figure 1 Score distribution and descriptive statistics: Nowicki-Strickland Locus of Control Scale for Children



$\bar{X}$ = 11.6
s.d. = 3.2
mdn. = 11.8
lower quartile = 9.5
upper quartile = 13.8
semi-interquartile range = 2.1

Figure 2 Score distribution and descriptive statistics: Sutton-Smith, Rosenberg Impulsivity Scale--D version



$\bar{X}$ = 13.9
s.d. = 4.9
mdn. = 13.8
lower quartile = 10.3
upper quartile = 17.3
semi-interquartile range = 3.5

Figure 3--GEFT Score Distributions and Item Statistics

Figure 3a Score distribution and descriptive statistics: Group Embedded Figures Test Section 1

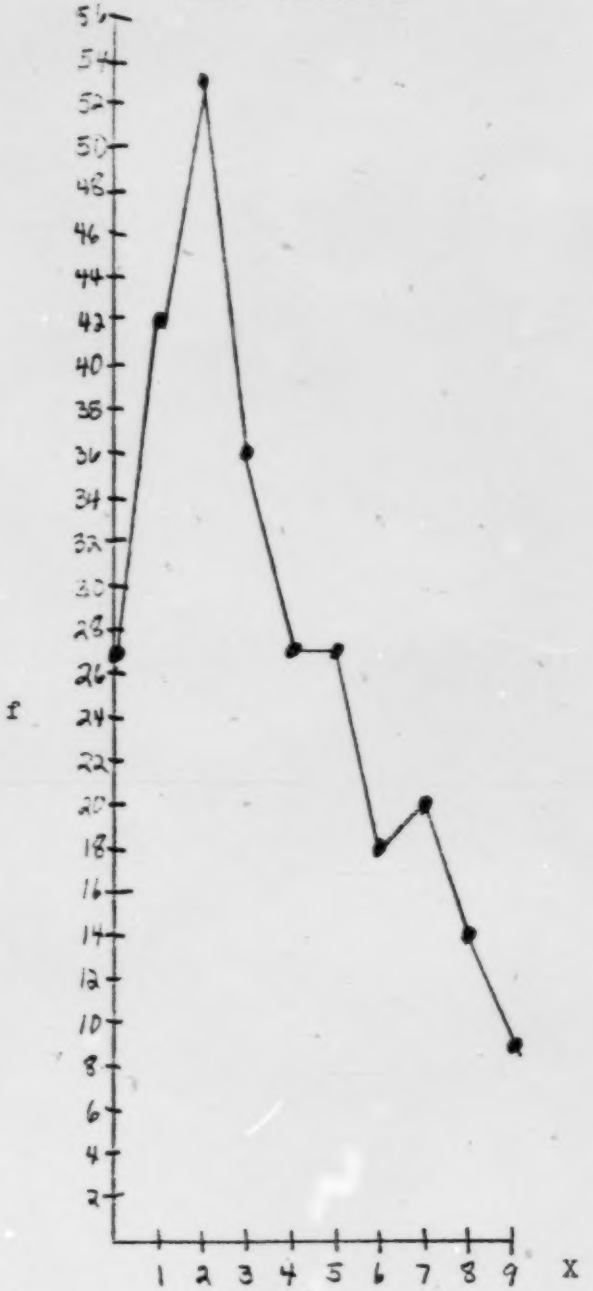


Table 6

$\bar{X}$ = 3.4
s.d. = 2.5
mdn. = 3.1
lower quartile = 1.4
upper quartile = 5.2
semi-interquartile range = 1.9

Figure 3b Score distribution and descriptive statistics: Group Embedded Figures Test Section 2

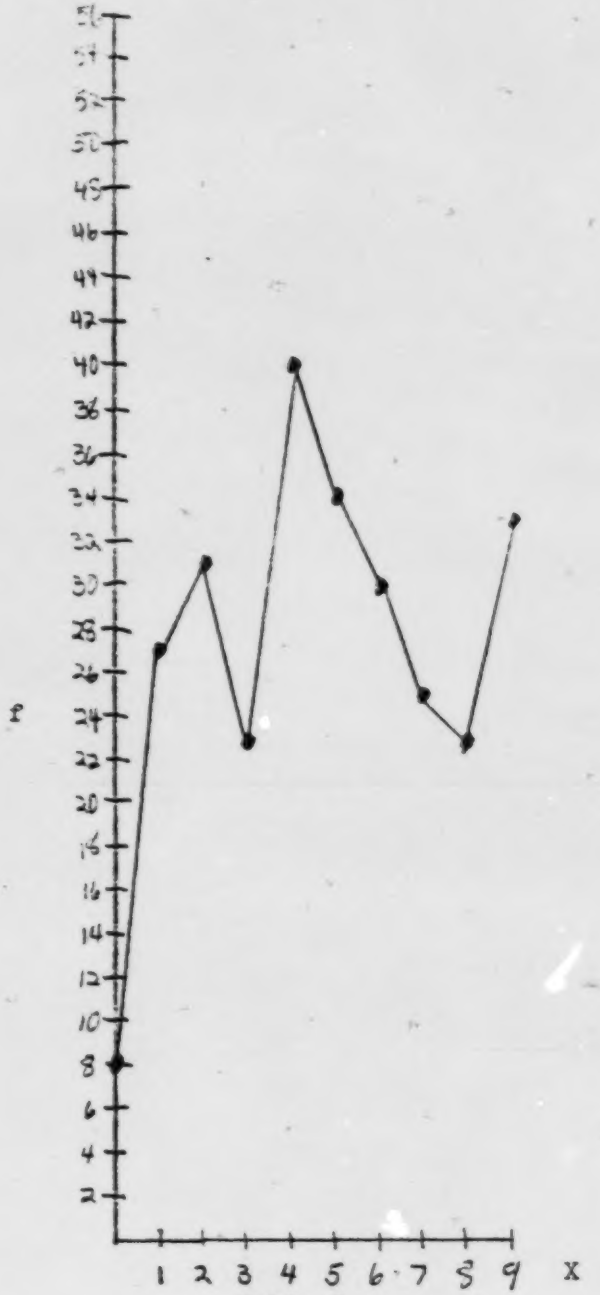
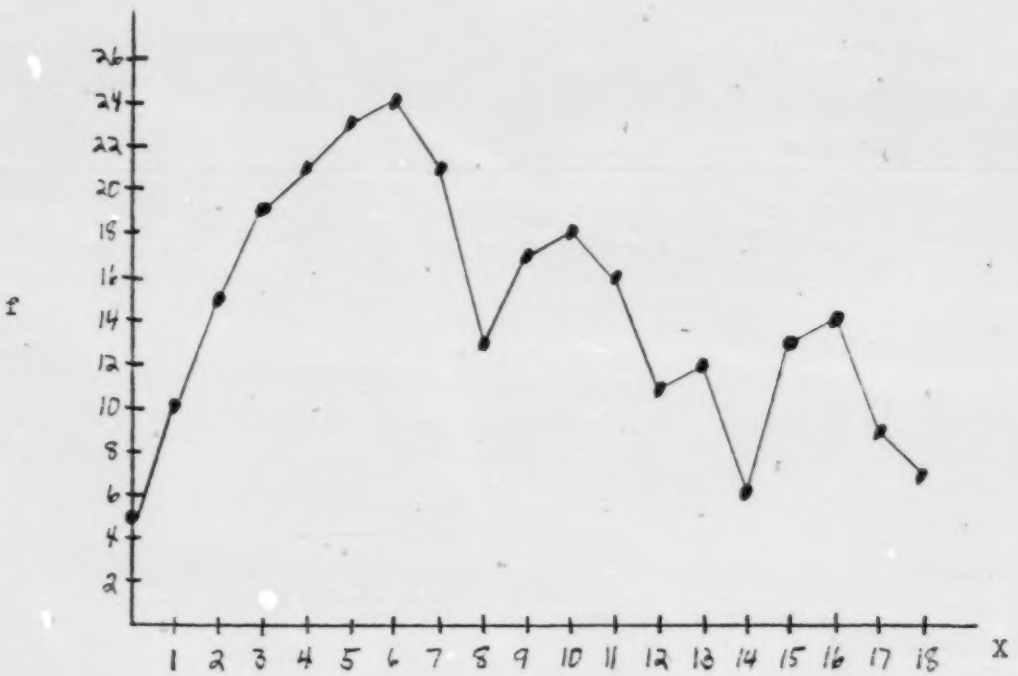


Table 7

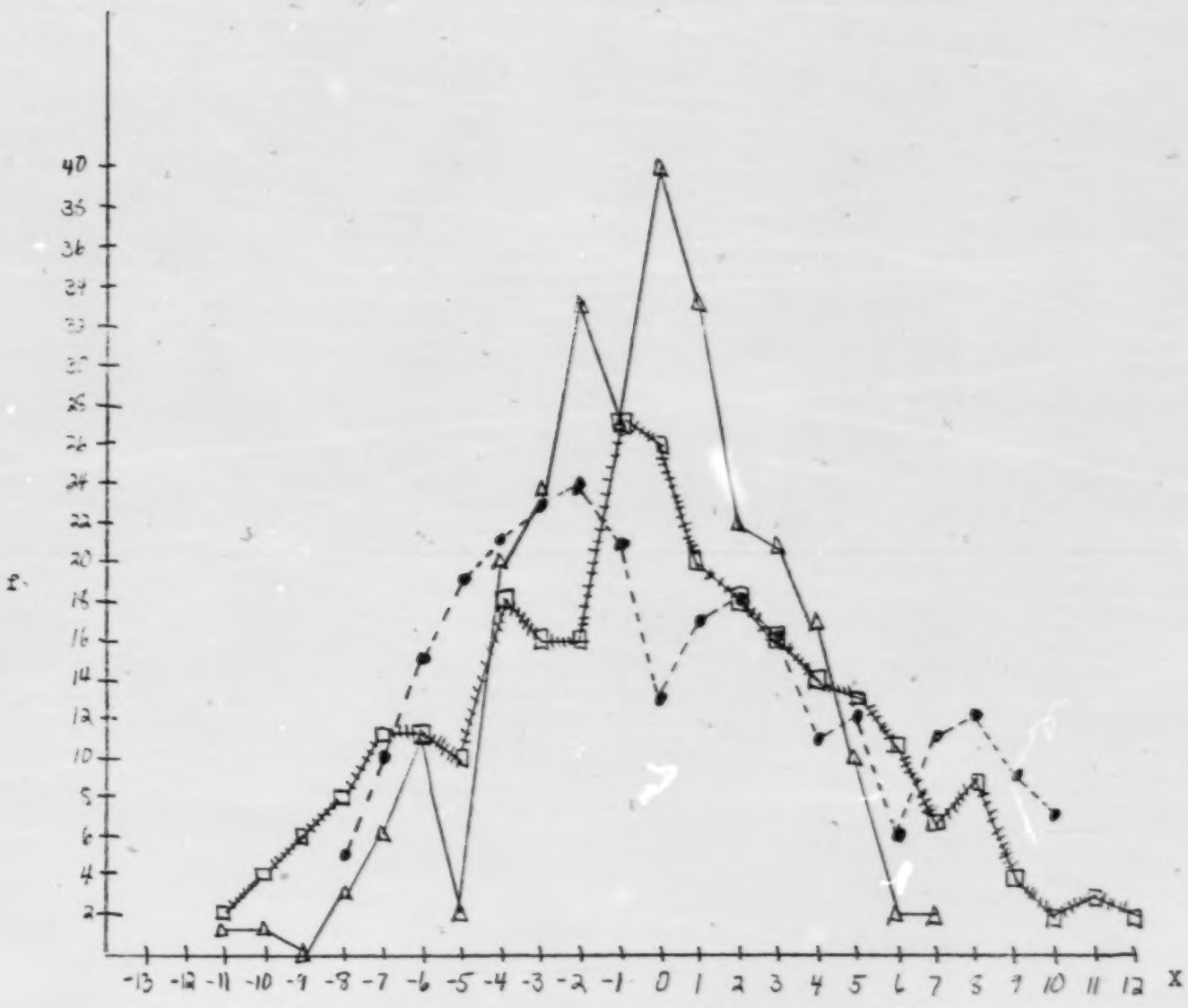
$\bar{X}$ = 4.8
s.d.= 2.6
mdn. = 4.7
lower quartile = 2.6
upper quartile = 6.9
semi-interquartile range = 2.1

Figure 3c Score distribution and descriptive statistics: Group Embedded Figures Test Total Score



$\bar{X}$ = 8.3
s.d. = 4.8
mdn. = 7.5
lower quartile = 4.4
upper quartile = 11.7
semi-interquartile range = 3.7

Figure 4 Score distributions:
Group Embedded Figures Test Total Score
Nowicki-Strickland Locus of Control Scale for Children
Sutton-Smith, Rosenberg Impulsivity Scale--D version



Legend: Nowicki-Strickland Locus of Control Scale for Children

Group Embedded Figures Test Total Score

Sutton-Smith, Rosenberg Impulsivity Scale--D version

Table 1

Test Presentation Modes

Mode 1	=	ABC*
Mode 2	=	BCA
Mode 3	=	CAB
Mode 4	=	BAC
Mode 5	=	CBA
Mode 6	=	ACB

* A = Group Embedded Figures Test
B = Nowicki-Strickland Locus of Control Scale for Children
C = Sutton-Smith, Rosenberg Impulsivity Scale--D version

Table 2

Item-Total Correlations:
Nowicki-Strickland Locus of Control Scale for Children

Denson, 1976	Nowicki & Strickland, 1971		Key	Item
	M	F		
.36	.49	.29	Y	1. Are some kids just born lucky?
.35	.17	.41	Y	2. Are you often blamed for things that just aren't your fault?
.38	.39	.33	Y	3. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?
-.06	.33	.06	N	4. Do you feel that most of the time parents listen to what their children have to say?
.24	.32	.26	Y	5. When you get punished does it usually mean it's for no good reason at all?
.29	.23	.27	Y	6. Most of the time do you find it hard to change a friend's mind (opinion)?
.42	.16	.40	Y	7. Do you feel that it's nearly impossible to change your parent's mind about anything?
.48	.49	.57	Y	8. Do you feel that when you do something wrong there's very little you can do to make it right?
.30	.32	.13	Y	9. Do you believe that most kids are just born good at sports?
.30	.26	.37	Y	10. Do you feel that one of the best ways to handle most problems is just not to think about them?
.36	.05	.29	Y	11. Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her?
.39	.14	.18	Y	12. Have you felt that when people were mean to you it was usually for no reason at all?

Table 2 Continued

Denson, 1976	Nowicki & Strickland, 1971		Key	Item
	M	F		
.05	.15	.30	N	13. Most of the time, do you feel that you can change what might happen tomorrow by what you do today?
.42	.32	.61	Y	14. Do you believe that when bad things are going to happen they are going to happen no matter what you try to do to stop them?
.47	.45	.34	Y	15. Most of the time do you find it useless to try to get your own way at home?
.42	.34	.52	Y	16. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?
.28	.35	.38	Y	17. Do you usually feel that you have little to say about what you get to eat at home?
.42	.30	.47	Y	18. Do you feel that when someone doesn't like you there's little you can do about it?
.47	.21	.31	Y	19. Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you are?
.09	.34	.26	N	20. Are you the kind of person who believes that planning ahead makes things turn out better?
.41	.27	.65	Y	21. Most of the time, do you feel that you have little to say about what your family decides to do?

Table 3

Nowicki-Strickland Factor Arrays

Item #	Item	Factor	Loading
21	Most of the time, do you feel that you have little to say about what your family decides to do?	1	.54
3	Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?	1	.44
19	Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you are?	1	.44
15	Most of the time do you find it useless to try to get your own way at home?	1	.39
7	Do you feel that it's nearly impossible to change your parent's mind about anything?	1	.38
2	Are you often blamed for things that just aren't your fault?	1	.37
4	Do you feel that most of the time parents listen to what their children have to say?	1	-.38
16	Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?	2	.60
8	Do you feel that when you do something wrong there's very little you can do to make it right?	2	.55
18	Do you feel that when someone doesn't like you there's little you can do about it?	2	.48
11	Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her?	2	.44
1	Are some kids just born lucky?	None	
5	When you get punished does it usually seem it's for no good reason at all?	None	
6	Most of the time do you find it hard to change a friend's mind (opinion)?	None	

Table 3 Continued

Item #	Item	Factor	Loading
9	Do you believe that most kids are just born good at sports?	None	
10	Do you feel that one of the best ways to handle most problems is just not to think about them?	None	
12	Have you felt that when people were mean to you it was usually for no reason at all?	None	
13	Most of the time, do you feel that you can change what might happen tomorrow by what you do today?	None	
14	Do you believe that when bad things are going to happen they are going to happen no matter what you try to do to stop them?	None	
17	Do you usually feel that you have little to say about what you get to eat at home?	None	
20	Are you the kind of person who believes that planning ahead makes things turn out better?	None	

Table 4

Item-Total Correlations:
Sutton-Smith, Rosenberg Impulsivity Scale--D Version

Denson, 1976	Item (from original scale)
.35	1. I like to keep moving around.
.20	2. I make friends easily.
.19	3. I must admit I'm a pretty good talker.
.20	4. Whenever there's a fire engine going someplace, I'd like to follow it.
.47	5. When things get quiet, I like to stir them up a little.
.46	6. I am restless.
.19	7. I like being "it" when games of that sort are played.
.41	8. It's fun to push people off the edge into a swimming pool.
.33	9. It's hard to stick to the rules if you're losing the game.
.46	10. I like to dare people to do things.
.38	11. I like to go around with lots of other people, not just one or two.
.31	12. I'm not known as a hard and steady worker.
.44	13. I like to just "blow off" steam.
.39	14. I don't think you should always have to do what you're told.
.40	15. I'll try almost anything once.
.35	16. I usually say the first thing that comes into my head.
.52	17. I often act on the spur of the moment without stopping to think.

.36

Table 4 Continued

Denson, 1976	Item (new to D-version)
-.01	18. I can't concentrate on my work when people are talking in the room.
.19	19. It's hard for me to save money even when I want to.
.20	20. When people are playing an exciting game, I want to get in it rather than just watch.
.26	21. I can't sit still when I hear really good music.
.50	22. It's fun to take chances.
.44	23. Sometimes I say or do things just to see how people will react.
.26	24. I but things I don't need just because I like them.
.36	25. I think museums are boring.
.41	26. I like "hard rock" music better than "soft rock" music.
.55	27. I seem to get into trouble a lot without even planning to.
.41	28. My friends think I'm a "character".
.38	29. I don't like to follow schedules or routines.
.19	30. I like to "tinker" with things.

.32

Table 5

Sutton-Smith and Rosenberg--D Version Factor Arrays

Item #	Item	Factor	Loading
22	It's fun to take chances.	1	.53
28	My friends think I'm a "character."	1	.44
1	I like to keep moving around.	1	.41
5	When things get quiet, I like to stir them up a little.	1	.40
13	I like to just "blow off" steam.	1	.39
8	It's fun to push people off the edge into a swimming pool.	1	.39
26	I like "hard rock" music better than "soft rock" music.	1	.38
3	I must admit I'm a pretty good talker.	1	.35
15	I'll try almost anything once.	1	.34
23	Sometimes I say or do things just to see how people will react.	1	.33
27	I seem to get into trouble a lot without even planning to.	2	+.55
25	I think museums are boring.	2	+.46
10	I like to dare people to do things.	2	+.39
9	It's hard to stick to the rules if you're losing the game.	2	+.39
12	I'm not known as a hard and steady worker.	2	+.35
14	I don't think you should always have to do what you're told.	2	+.31
17	I often act on the spur of the moment without stopping to think.	1 2	.33 .36
6	I am restless.	1 2	.33 .34
2	I make friends easily.	None	

Table 5 Continued

Item #	Item	Factor	Loading
4	Whenever there's a fire engine going someplace, I'd like to follow it.	None	
7	I like being "it" when games of that sort are played.	None	
11	I like to go around with lots of other people, not just one or two.	None	
16	I usually say the first thing that comes into my head.	None	
18	I can't concentrate on my work when people are talking in the room.	None	
19	It's hard for me to save money even when I want to.	None	
20	When people are playing an exciting game, I want to get in it rather than just watch.	None	
21	I can't sit still when I hear really good music.	None	
24	I buy things I don't need just because I like them.	None	
29	I don't like to follow schedules or routines.	None	
30	I like to "tinker" with things.	None	

Table 6 Reliability Estimates: Group Embedded Figures Test

	Section 1	Section 2	Total Section 1 + Section 2
KR_{20}	.78	.81	.88

Spearman-Brown Sec. 1 vs. Sec. 2	$r_{12} = .76$ $r_{12_{cor.}} = .81$

Table 7 Item-Total Correlations: Group Embedded Figures Test

Item #	Section 1 only	Section 2 only	Total (Sec. 1 + Sec. 2)
1	.50		.46
2	.66		.63
3	.70		.69
4	.71		.70
5	.46		.43
6	.61		.53
7	.70		.65
8	.53		.45
9	.56		.53
10		.58	.51
11		.66	.60
12		.44	.38
13		.70	.70
14		.58	.58
15		.68	.67
16		.65	.60
17		.67	.58
18		.65	.64

Table 8 Loadings: Group Embedded Figures Test

Item #	Section 1 only Factor 1	Section 1 only Factor 2	Section 2 only	Total (Sec. 1 + Sec. 2)
1	.41			.35
2	.71			.61
3	.57			.54
4	.61			.63
5	.29			.39
6	.44			.46
7		.63		.51
8		.62		.48
9	.37			.42
10			.50	.55
11			.60	.48
12			.32	.34
13			.67	.51
14			.49	.48
15			.64	.57
16			.59	.56
17			.60	.48
18			.60	.51

Table 9 Intercorrelations among the three measures (N = 274)

	GEFT-Total**	NS	SR--D version
GEFT-Total	-	.12 (.02)*	.15 (.01)
NS		-	.23 (.001)

** GEFT-Total = Group Embedded Figures Test Total Score
NS = Nowicki-Strickland Locus of Control Scale for Children
SR--D version = Sutton-Smith, Rosenberg Impulsivity Scale--D version

* values in parentheses indicate significance levels

Table 10

Summary of Factor Analysis for All Items

Factor	Eigenvalue	Pct. of Var.	Cum. Pct.
1	6.47466	21.4	21.4
2	3.87669	12.8	34.2
3	2.72678	9.0	43.2
4	1.40200	4.6	47.9
5	1.32014	4.4	52.2
6	1.23931	4.1	56.3
7	1.12089	3.7	60.0
8	1.03195	3.4	63.4
9	0.96571	3.2	66.6
10	0.91000	3.0	69.6
11	0.89704	3.0	72.6
12	0.85422	2.8	75.4
13	0.79456	2.6	78.0
14	0.76222	2.5	80.6
15	0.75470	2.5	83.1
16	0.69695	2.3	85.4
17	0.67232	2.2	87.6
18	0.61744	2.0	89.6
19	0.60505	2.0	91.6
20	0.60035	2.0	93.6
21	0.54143	1.8	95.4
22	0.51479	1.7	97.1
23	0.44207	1.5	98.6
24	0.43848	1.4	100.0

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